

Biogeochemical nutrient cycles and nutrient management strategies

Daniel J. Conley

Department of Marine Biology and Microbiology, National Environmental Research Institute, P.O. Box 358, DK4000 Roskilde, Denmark E-mail: dco@dmu.dk

Key words: eutrophication, nutrient limitation, nitrogen, phosphorous, silicate

Abstract

Nutrient loading by riverine input into estuarine systems has increased by 6–50 times for the N load from pristine conditions to present, whereas a 18–180 times increase has been observed in the P load. Reductions in the ratio of N to P delivery has also occurred with time. In a review of nutrient limitation in estuarine systems, it is shown that many estuarine systems display P limitation in the spring, switching to N limitation in the summer with some estuaries displaying dissolved silicate limitation of the spring diatom bloom. Historical and recent changes in nutrient loading and their effect on nutrient limitation have intensified the debate on the control of nutrient delivery to estuaries from both agricultural and point sources, and as to what nutrient (N or P) should be managed for in estuarine systems. It is hypothesized that potential reductions in P may help oxygen depletion especially in deep estuaries and reduce fast growing macrophytes such as *Ulva* sp., although P reductions probably will have little effect on summer chlorophyll concentrations, an important recreational management goal. Reductions in N loading should reduce summer chlorophyll concentrations and improve the conditions for submerged aquatic vegetation and thus improve ecosystem functioning. Finally, if only P reductions are pursued, that is if we are able to reduce P such that it is limiting year around in estuarine systems, it is likely that the export of N from estuarine systems would increase to the bordering N-limited marine systems, thus only exporting the problem of enhanced production with eutrophication.